An analysis of the Department of Defense deregulated electricity contract

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An Analysis of the Department of Defense Deregulated Electricity Contract

Master of Science Project

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Dear Sir or Ma'am:

Enclosed are two copies of my Master of Science in Electrical Engineering major report for your reference. Please do not hesitate to contact me if I can be of further assistance.

Very respectfully,

[redacted]

Robert E. Lin
LT, CEC, USN

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1. Introduction

This investigation of the first Department of Defense (DOD) energy contract in California's deregulated electricity market with New Energy Ventures, Inc., of Los Angeles, California, is submitted as a Master of Science project under the advisement of Drs. C. C. Liu and M Damborg, Professors of Electrical Engineering, University of Washington. The project stemmed from personal interest, professional commitment, and anticipated beneficial application to the United States Navy. The approach taken to evaluate the electricity contract is based on the current California market structure. Specifically considered are the contract specifications; the pricing elements of the contract and how they are related to the present deregulated market; a zero-risk versus shared-risk savings comparison; and concluding with strong points and disadvantages of the electricity contract as it relates to the Department of Defense (DOD).

Included in section two is a brief history leading to the current deregulation, and a basic description of the current California market structure. Section three describes the electricity contract between the DOD and the power marketer, New Energy Ventures, Inc. The contract pricing elements are listed in section four. Section five examines the expected savings comparison between the government and an average commercial consumer. Conclusions on the advantages and disadvantages of this electricity contract are summarized in section six.

2. California Utility Restructuring Background Information

Since 1992, the California Public Utilities Commission (CPUC) has been developing a policy to restructure the electric utility industry. Under its proposal, the CPUC would end the practice of a single utility providing all electric services within its service area, and introduce choice and competition to provide consumers with more economical electricity services. The CPUC restructuring policy applies to the regulated utilities in California; a similar policy to open access to the wholesale transmission system is being advanced nationwide by the Federal Energy Regulatory Commission. Both federal and state policies were triggered by the Federal Energy Policy Act of 1992 which introduced market competition to the energy industry as a means of reducing consumer electric rates and improving efficiency.[1-5]

On December 20, 1995, the CPUC issued a decision that encouraged competition among suppliers of electricity, offered consumers a choice in energy suppliers, and reformed how the investor-owned utilities would be regulated. This new market required the establishment of a statewide Independent System Operator (ISO) and a power pool called the Power Exchange (PX). This new era of the electricity

industry was signed into law (Assembly Bill 1890) on September 24, 1996, legislation that opened the state's electricity market to competition.[1-5]

The actual restructuring of California's electric industry began March 31, 1998, and the traditional role of a single utility providing all electrical services (i.e., generation, transmission, and distribution) came to an end. This movement has had a significant impact on California consumers and its investor-owned utilities. For example, one important change made by AB 1890 is to treat electric power generation, transmission, and distribution as three distinct functions. This shift complemented the creation of a competitive market for generation and a PX, a spot price market where electricity is bought and sold.[1-5]

The PX is under Federal Energy Regulatory Commission jurisdiction and functions as an independent agency that auctions the buying and selling of electricity. It schedules generation, determines market-clearing prices, and performs settlement and billing for market participants. Moreover, the newly created ISO manages the high voltage transmission lines and ensures reliable and fair transfers of electricity from generators to distribution companies. Distribution will, however, remain under utility monopoly with regulatory oversight by the CPUC.[1-5]

One of the most important concepts created by AB 1890 allows power producers or brokers to sell directly to retail consumers. Retail competition enables consumers to choose direct access. The state's investor-owned utilities, municipal utilities, and cooperatives will continue to distribute power to consumers and continue to be regulated. During the transition period, utilities will have the opportunity to recover competition transition costs from consumers.[6,7] This report focuses on the pricing elements of the electricity contract as related to the current market structure and its derived savings.

- The Basic Market Structure

A number of participants make up the new market structure: Generators, PX, Scheduling Coordinators (bilateral transactions), ISO (grid dispatch and transmission access), Utility Distribution Companies (UDCs), Retail Marketers (energy service provider), and Customers (load). All of these entities have specific roles in the new power market. The new market structure block diagram is depicted in figure 1. [1-5]

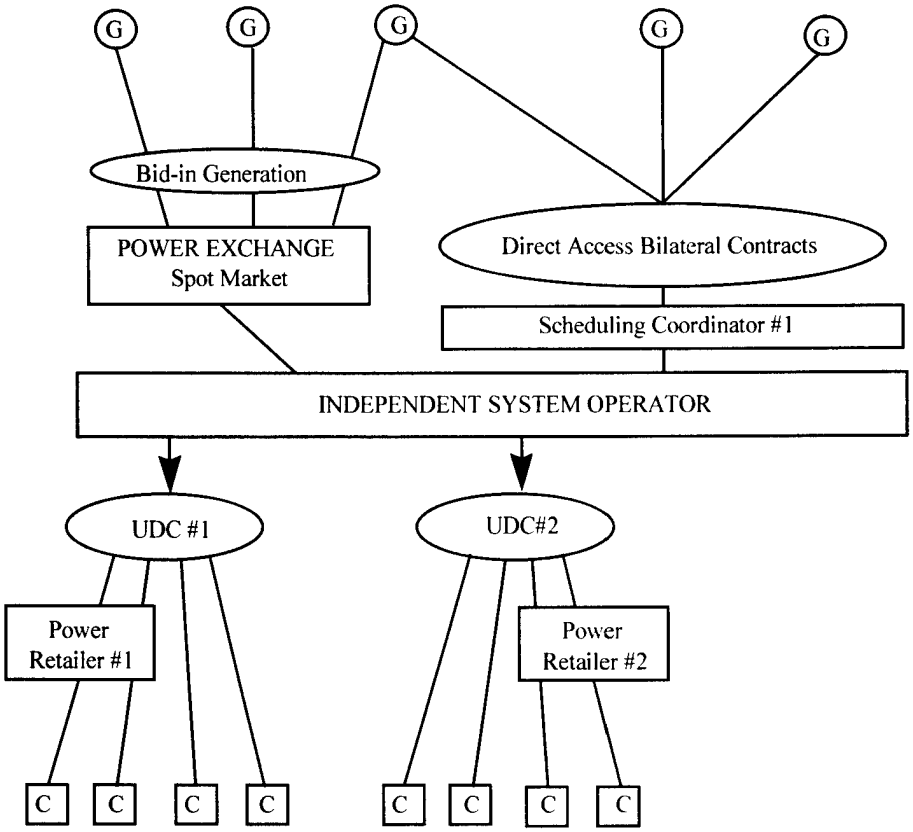

Fig. 1 New California Market Structure

A five-member Oversight Board will monitor this market structure to ensure that the interests of the people of California are served. It performs the following functions:

- Oversee the Independent System Operator and the Power Exchange.
- Determine the composition and terms of service and appoint members of the governing boards of the Independent System Operator and the Power Exchange.
- Serve as an appeal board for majority decisions of the Independent System Operator governing board. [5]

A brief description of the new California market elements is listed below:

Generators

Generators may bid power into the PX and respond to the ISO, or schedule power through a Scheduling Coordinator and comply with scheduling coordinator instructions. The generators provide transmission

losses to transmission and distribution boundaries, and submit bills to retailers and/or a scheduling coordinator for energy and ancillary services provided. [3]

Power Exchange (PX)

The California Power Exchange is a non-profit corporation with the primary purpose of providing an efficient, competitive energy auction open on a non-discriminatory basis to all suppliers and spot market participants that meet the loads of exchange customers at market prices. The PX manages the competitive trading of power in the day-ahead and hour-ahead (forward) markets. The PX is a Scheduling Coordinator and submits balanced schedules to the ISO for all of its participants. All other services used to maintain a secure and aggregated reliable power supply are traded in markets managed by the ISO. The PX accepts demand and generation bids from its participants, and determines the Market Clearing Price (MCP) at which energy is bought and sold. Subsequently, balanced demand and supply schedules for the successful bidders are submitted to the ISO. In addition to managing the forward markets, the PX performs settlement functions with the ISO, PX participants, and other Scheduling Coordinators; it reports usage to the ISO for settlements and provides some operating instruction to generators and retailers. [10-12]

Scheduling Coordinators (SCs)

Scheduling Coordinators (SCs) submit balanced schedules and provide settlement ready meter data to the ISO. SCs settle with generators and retailers, the PX and the ISO; maintain a year round 24-hour scheduling center; provide some operating instructions to generators and retailers; and transfer schedules in and out of the PX. [1,3,5]

Energy Service Provider (Power Retailers)

Power retailers buy power for and market power to retail customers, and serve as demand aggregators for retail loads. Retailers also bill retail customers for energy and contracted services, schedule load and generation through a SC or PX, and pay SC and/or generators for energy. [1,3,5]

Independent System Operator (ISO)

In this market arrangement, the ISO functions are various and multi-faceted. The ISO will ensure efficient use and reliable operation of the transmission grid consistent with achievement of planning and operating reserve criteria no less stringent than those established by the Western Systems Coordinating Council and the North American Electric Reliability Council. To fulfill these criteria for the transmission grid, the ISO controls dispatch of generation, manages grid reliability, provides open access to the transmission,

and administers congestion management protocols. It coordinates day-ahead and hour-ahead schedules. The ISO performs real time balancing of load and generation, settles real time imbalances, and transacts ancillary service sales and purchases. As the control area operator for most of California, the ISO satisfies the electric power demand by stabilizing the following variables: (1) the power output of the generating units within the electric power system; (2) the energy purchased from entities outside the electric power system; and (3) the energy sold to entities outside the electric power system. Simultaneously, the ISO maintains a scheduled interchange with other control areas, maintains the frequency of the electric power system, and provides sufficient generation. [8,9]

Utility Distribution Companies (UDCs)

UDCs distribute service to all customers within their jurisdiction; meter energy delivered; and bill for energy and use of transmission, distribution and Competitive Transition Charges. They also offer bundled energy tariffs to their customers, buy bulk power from the PX, and offer optional meter reading and usage measurement services to other market participants. [7]

Customers/Consumers

All customers may choose direct access via a local utility retailer, power marketer, or generator. Or, they may opt to remain a single customer or become part of an aggregated load under utility tariff rates.[1-7]

3. Department of Defense Deregulated Electricity Contract

- Contract Information

In response to utility restructuring in California, the DOD directed the Defense Energy Support Center to solicit a supply contract for electricity and any ancillary and/or incidental services. This contract is the first long-term electricity supply contract by the DOD under a competitive market. The solicitation for electric service was issued on February 28, 1998, and the contract awarded to the New Energy Ventures (NEV) Corporation on May 12, 1998. The duration of the contract is from June 1998 to March 2002. The scope of the contract requires New Energy Ventures to supply electricity and related services to Army, Navy, and Air Force facilities that are eligible to participate in California's deregulated marketplace. These facilities include, among others, Vandenberg Air Force Base; Fort Hunter Liggett, Army National Guard Training Base; the Navy Postgraduate School, Monterey; Miramar Naval Air Facility; Marine Corps Base, Camp Pendleton; and the Navy Shipyard in Long Beach. The four-year contract for 1,200,000 MWh of electricity annually is worth approximately $300 million dollars, and is

one of the largest deals secured by an energy service provider since California created the deregulation framework for the state in 1995. [13,14]

NEV demonstrated not only the ability to provide the best value on electricity, but also the financial strength and operational expertise to meet the needs of the DOD in California. The selection process included evaluating all prospective energy service providers in the following criteria: technical capability, industry experience, past performance, and pricing. The contract is intended to cover all military service accounts; however, citing non-profitability at some military installations, only a few profitable locations are under the contract terms. This lack of comprehensive coverage implies that the market is relatively inefficient and competition insufficient.

The contract pricing option specifies that the prices paid must be a percentage discount off the PX credit under the applicable tariff for those accounts awarded under the contract; the resulting contract price is a variable discount off the applicable tariff as computed by UDCs. [13]

- Regulated Market/Post-Deregulation Market

Prior to deregulation, DOD military installations negotiated services contracts with local UDCs for electric services. There were no alternatives available to the federal government, thus ensuring a local monopoly, shown in figure 2.

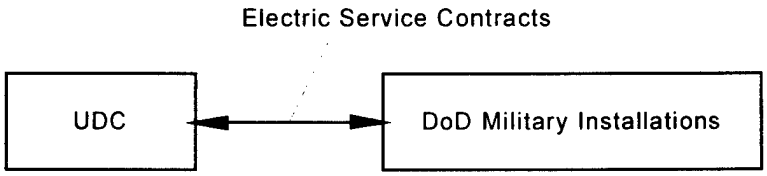

Fig. 2 Regulated Market Prior to Deregulation

After the inception of deregulation, the spirit of competition started to lower the cost of electricity. The post-deregulation market displays a stark contrast to the regulated market and is depicted in figure 3.

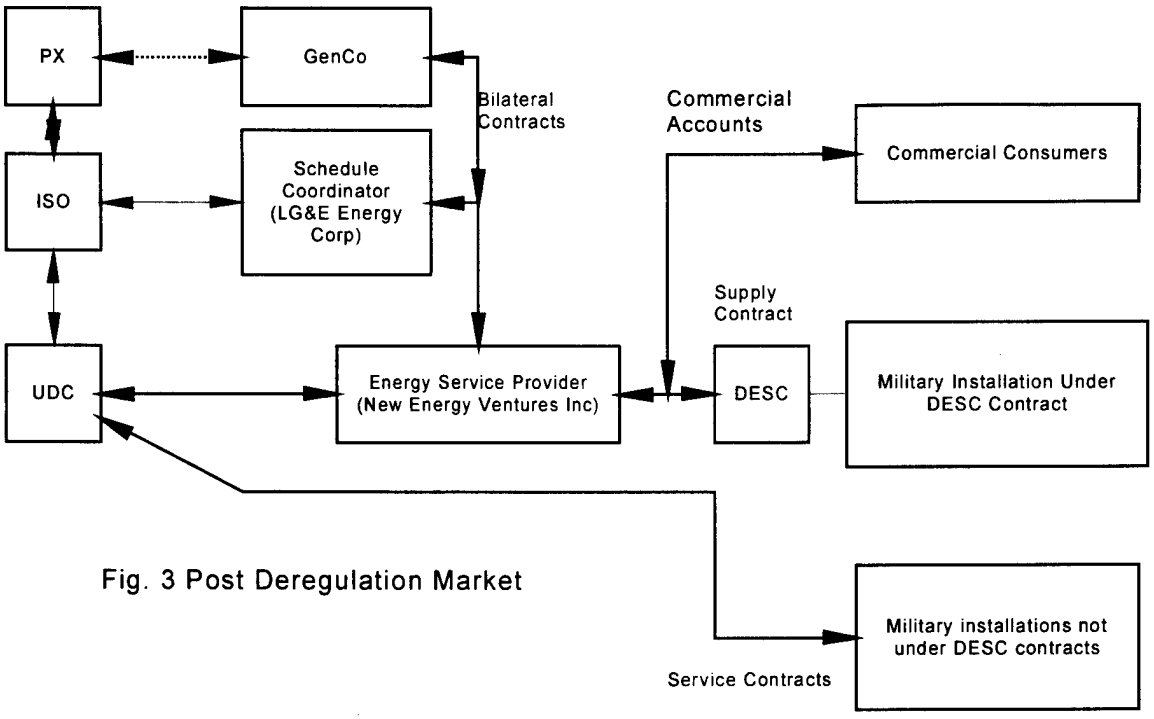

Fig. 3 Post Deregulation Market

As shown in figure 3, NEV acquires bilateral contracts with Generation Company (GenCo) for electricity generation, and Louisville Gas and Electric (LG&E) for schedule coordination and billing services. These bilateral contracts impose an obligation for the physical delivery of energy and are formulated outside of the PX markets. Specifically, the agreement between NEV and LG&E requires LG&E to provide NEV with: [13,14]

- Electricity scheduling coordination services, including day-ahead scheduling of electricity deliveries with ISOs or utilities; coordination of NEV's electricity supplier commitments; and arranging purchases or sales to achieve real-time energy balancing.
- Customer administration services, including billing and energy use statements; advanced communications technology to facilitate interaction with customers; and electronic bill payment.
- Customer energy management services, including automatic customer metering services as well as demand management services, such as energy audits and billing analyses.

Based on these contracts, NEV managed to provide lower cost electricity than the UDC market clearing price (MCP) derivative cost. In addition, NEV also receives billing information from UDCs regarding UDC charges and PX energy credit to compute billing charges for its customers.

It is precisely this marketing process that enables NEV to afford greater savings for consumers than that of the UDC.

4. Electricity Pricing Elements

Electricity pricing is based on two cost categories: the cost of electricity and UDC charges. The cost of electricity is defined as the cost incurred by NEV for purchasing and distributing electricity through bilateral contracts with GenCo and LG&E. The pricing elements are as follows: [13,14]

- Cost of electricity (C_e):
  - Generation Cost (G_c)-- The generation cost of electricity (related to bilateral contract pricing).
  - ISO/PX Charges -- (IP_c) Charges imposed by ISO/PX for access, settlement, transmission, distribution and grid management.
  - Transaction charges (TX_c)-- Costs of transaction services provided by NEV, including scheduling, procurement, meter reading and billing
  - NEV share of savings (NEV_s)

Where the cost of electricity C_e can be expressed as

$$C_e = G_c + IP_c + TX_c + NEV_s \qquad (4.1).$$

Equation (4.1) applies to all NEV commercial customers, and is a risk sharing composition that can be greater or less than the PX energy credit, depending on whether the spot market price is greater or less than the bilateral contract price. This is the key to NEV's capacity to produce substantial cost savings for the risk sharing commercial consumers.

The UDC charges are defined as charges imposed for transmission and distribution, including Competitive Transition and Public Goods charges. The pricing elements are as follows:

- UDC Charges (U_c):
  - Competition Transition Charge (CTC) (C_{TC})-- The CTC is an element on Californian electric bills designated to pay for the stranded investment of the utility company. The duration that the CTC will be in effect varies by the energy usage class of the customer.

The CPUC reviews the operations of the utilities and determines how much money the utilities are allowed to recover in this account.

- Transmission Charges (T_c)--Charges levied by the UDC for electricity transmission.
- Distribution Charges (D_c)--Charges assessed by the UDC electricity distribution.
- Nuclear Decommissioning (N_D)--Charges associated with closing nuclear power plants.

Where the UDC charges U_c can be expressed as

$$U_c = C_{TC} + T_c + D_c + N_D \qquad (4.2).$$

- DOD Electricity Contract Cost Formulation

The contract cost (C_s) for a specific military installation is computed based on the pricing elements of the aforementioned cost categories, the cost of electricity (C_e) and UDC charges (U_c), and can be expressed as an annual summation. Specifically for DOD's electricity contract with NEV, C_e is a function of PX energy credit (C_{px}), a percentage discount (D_{px}) off C_{px}, which can be defined as

$$C_e = C_{px}(1 - D_{px}) \qquad (4.3).$$

The contract cost as an annual sum,

$$C_s = \sum_{Annual} C_e + U_c = C_{px}(1 - D_{px}) + U_c \qquad (4.4);$$

therefore, the total contract cost (C_T) can be expressed as a sum of C_s for all contracted military locations,

$$C_T = \sum_{Location} \sum_{Annual} C_{px}(1 - D_{px}) + U_c \qquad (4.5).$$

The PX energy credit (C_{px}) is the cost of power purchased from the PX, as well as power services necessary to maintain system reliability, and the administrative costs of the PX and the ISO.[14] In addition, both C_{px} and U_c are heavily regulated by the CPUC and are relatively fixed in equations (4.4) and (4.5) in determining the total contract cost. The percentage discount (D_{px}) off the PX energy credit is determined by NEV; it is a function of source of supply, usage, profit margin, billing service, and cooperate overhead, and it is largely influenced by competition--more competition translates into higher percentage of discount.

Per equation (4.6), to minimize the total contract costs, the percentage discount quantity ($1 - D_{px}$) must be minimized, and this can only be achieved if the market is robustly competitive.

$$\min C_T = \sum_{\text{Location}} \sum_{\text{Annual}} C_{px} \ \min\{(1 - D_{px})\} + U_c \qquad (4.6)$$

Unfortunately, the electricity contract between the DOD and NEV did not manifest under vigorous competition. NEV was the only responsible bidder among the candidates, implying that NEV secured the contract unopposed. Since the contract was awarded to a single firm without competition, the percentage discounts (D_{px}) offered for various military installations will be minimal at best. And by locking into a long-term contract with minimal D_{px}, the government is not taking full advantage of the anticipated competition driven savings in a fully deregulated market. To maximize the percentage discounts, D_{px}, the government must award short-term annual contracts to reap the fruit of competition from a mature competitive California market, a process that will take at least four to five years.

5. Electricity Savings Comparison

- Zero Risk Versus Risk Sharing Savings Comparison

The zero risk versus risk sharing savings comparison is centered on the difference between the total UDC cost of electricity (U_{cost}) and the total cost of electricity ($\overset{G}{E}_{cost}$ = government and $\overset{C}{E}_{cost}$ = commercial consumer) charged by NEV to its customers. The DOD's zero risk total cost of electricity is computed using equation (4.3), whereas the commercial consumer's risk sharing total cost of electricity is the sum of (4.1) and (4.2). Since the government insisted on guaranteed savings (zero risk) in awarding the electricity contract, its share of savings from the deregulation is expected to be less than net savings of an average comparably sized commercial customer, provided that the bilateral contract price is less than the spot market price. The actual savings calculation is based on the following formulation: [14]

1. Total UDC cost of electricity: $U_{cost} = U_c + C_{px}$, where U_c is defined in equation (4.2) and C_{px} is the cost of power purchased from the PX.
2. Total cost of electricity: $\overset{G,C}{E}_{cost} = U_c + \overset{G,C}{C}_{cost}$

   Note: $\overset{G}{C}_{cost} = C_{px}(1 - D_{px})$, (government cost of electricity)

   $\overset{C}{C}_{cost} = C_e = G_c + IP_c + TX_c + NEV_s$ (commercial consumer cost of electricity)
3. Actual savings = $U_{cost} - \overset{G,C}{E}_{cost}$

The following example is a monthly savings comparison between a military installation and a commercial consumer with a monthly demand of greater than 20kW. Both sites are served under the same tariff class with similar usage patterns, and 1-% PX discount D_{px} is used for the military installation. Since the deregulated market is relatively young, it does not have insufficient historical data for this example. Appropriately, simulated cost data were used to demonstrate the conceptual savings variance between zero risk and risk sharing pricing options. In addition, C^{c}_{cost} is based on the provisions that the bilateral contract price is less than the spot market price. [14]

Monthly Savings Comparison Example

Government Savings per 1% Discount off C_{px} (zero risk)		**Savings of an Avg Commercial Consumer (risk sharing)**	
UDC Charges (U_c)	$24,870.00	UDC Charges (U_c)	$24,870.00
PX Energy Credit (C_{px})	$15,705.00	PX Energy Credit	$15,705.00
Total UDC Cost of Electricity (U_{cost})	$40,575.00	**Total UDC Cost of Electricity** (U_{cost})	$40,575.00
UDC Charges (U_c)	$24,870.00	UDC Charges (U_c)	$24,870.00
(PX Energy Credit, C_{px})	$15,705.00		
(1% off C_{px})	-$157.05		
Customer's Cost of Electricity (C^{G}_{cost})	$15,547.95	Customer's Cost of Electricity (C^{C}_{cost})	$14,048.00
Total Cost of Electricity (E^{G}_{cost})	$40,417.95	**Total Cost of Electricity** (E^{C}_{cost})	$38,918.00
		Savings	$1,657.00
		NEV's share of savings (25%)	$414.25
Net Savings	$157.05	**Net Savings**	$1,242.75

Note: (1) Simulated data are used to illustrated conceptual savings comparison between zero risk and risk sharing pricing options.

(2) C^{c}_{cost} is based on bilateral contract price less than spot market price.

It is quite obvious that the government's insistence on guaranteed savings (zero risk) is reflected in its smaller share of savings, which is $1,085.70 (619%) less than its commercial counterpart. In comparing utility services and prices, the PX energy credit is the benchmark against which all energy service providers are forced to compete. If an energy service provider charges a consumer a sum for electricity that is less than the PX energy credit, the consumer should save money. The converse is true if a consumer is charged a sum for electricity that is greater than the PX energy credit. In this case, the consumer should lose money and would have been better off remaining an UDC consumer.

By insisting on a pricing option that would guarantee savings off the PX energy credit, the government missed the potential for a greater savings from the energy service provider's incentive to enhance its share of savings by being more efficient and cost conscious. By asserting zero risk pricing, the government's savings are substantially less than the net savings of an average commercial consumer under the same energy service provider. Unless it is willing to join the ranks of average commercial consumers, the government cannot achieve the level of savings enjoyed by its commercial counterpart.

6. Conclusions

The DOD's introduction to open market conveyance for electricity contracts in California's newly deregulated market was timely executed with high aspiration, i.e., to procure the spoils of lower electricity costs. However, as with any pioneering endeavor, a developing market combined with necessary expedience in awarding the contract yielded positive impacts for DOD consumers and unforeseen, although rectifiable, disadvantages. Finally, an innovative approach of diversified contract portfolio will bridge the opposite extremes of zero risk and risk sharing and maximizes the electricity savings.

Positive Impact. Dissatisfied with the monopoly of a regulated market, the DOD was quick to recognize an opportunity for competition in California's energy market deregulation, and acted boldly and timely to effect a positive change in "business as usual" and break the exclusive hold on government electricity contracts. This proactive course of action will undoubtedly lead to improvement of subsequent electricity contracts.

Disadvantages.

- Fixed percentage discount (D_{px}). The contract pricing option structure restricts the expected savings solely to the percentage discount off the PX energy credit. This fixed percentage discount is based on the market competition and is not negotiable throughout the contract period. That the contract was

awarded to the only responsible bidder (all other respondents having been disqualified for insufficient operational capabilities) suggests that the competition needed to enhance the savings was not present. A possible solution would be to use annual (short-term) solicitations to encourage competition within a developing market. Once the market matures, returning to long-term contracts would be more beneficial in (a) establishing competitive energy savings, and (b) reducing higher administrative costs associated with short-term contracts.

- Guaranteed savings/zero risk. Since the DOD insisted upon a guaranteed savings option with zero risk, its share of savings is less than an average NEV commercial consumer of comparable load. The government can improve its savings by sharing the market risks rather than requiring guaranteed savings. If the government does not view risk sharing as a plausible option, it could perhaps utilize its enhanced value of purchasing power, due to deregulation, to implement service contracts with better-negotiated pricing options of modulated risks. It is imperative that the government recognizes its transparent, but powerful, improved value of purchasing power and utilize it timely and judiciously. A sensible realization of service contracting with constant vigilance will cut through misleading promotions and deceptive advertising that have plagued the telephone industry deregulation.
- Long-term contract. Currently the market is underdeveloped and lacks competition; therefore, it is presently advisable to have a yearly contract vice a long-term option. The low discount rates produced by a young deregulated market reflect its inherent uncertainty and the reluctance of energy service providers to bear the necessary risk to compete. Such reluctance may initially reduce the number of responsible bidders to promote robust contention and ensure the most competitive environment. However, as the market transitions with each passing year, bidder confidence will grow, increased participation will follow, and, consequently, the market will become more intensely competitive and efficient making a long-term contract sensible and desirable.
- Contract and pricing flexibility. The lack of contract and pricing flexibility resulted in the DOD's inability to take advantage of a rapidly developing competitive market. This inflexibility implies that the government cannot change the pricing option or contractual elements without issuing costly contract modifications. By adding contract options for renegotiations and renewal to timely modulate the contract, the government will reap the competitive benefits.
- Supply contract. This type of contract is awarded based on total pricing and relies on the market competition to drive the price down. It has no means to negotiate a reasonable profit margin, nor does it have any way to ensure the validity of cooperate overhead charges. Therefore, unless the market competition is strong and consistent, the supply contract may include overly inflated profit margins and invalid overhead charges.

Diversified Contract Portfolio. If the bilateral contract price--between NEV and GenCo--is consistently lower than the spot market price, it is to the government's advantage to select the risk sharing pricing option. Conversely, if the spot market price is lower than the bilateral contract price, it is in the government's best interest to stay with the guaranteed savings (zero risk) pricing option. Therefore, it is prudent for the government to maintain a contract portfolio with both zero risk and risk-sharing pricing options for various locations to ensure optimization of its savings in California's deregulated electricity market. The ratio between zero risk and risk-sharing contracts remains an interest for future research.

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